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Stringer et al.

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(54) **VECTOR-BASED CUSTOMIZABLE POINTING INDICIA**

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(51) **Int. Cl.**

G09G 5/00	(2006.01)
G09G 5/08	(2006.01)
G06F 3/0481	(2013.01)

(52) **U.S. Cl.**

CPC ***G09G 5/08*** (2013.01); ***G06F 3/0481*** (2013.01); *G06F 2203/04806* (2013.01); *G09G 2340/045* (2013.01)

(58) **Field of Classification Search**

CPC combination set(s) only.
See application file for complete search history.

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(57) **ABSTRACT**

A method of rendering customized pointing indicia including the steps of monitoring application program interface messaging and intercepting a call for a unique system pointer identifier. A stored collection of predefined vector shapes is accessed, from which a predefined vector shape is selected correlated to the current system pointer identifier. The stroke and fill attributes are set for the vector shapes. A sequence of rasterized frames of vector shapes having different attributes are created and displayed to produce animated pointing indicia effect. The customized vector shape is rasterized and displayed to an end user operating a computer. Customization, animation, and magnification of pointing indicia are performed responsive to user input, which may be a touch-screen event, body movement, hand gesture, mouse event, or a key stroke.

20 Claims, 18 Drawing Sheets

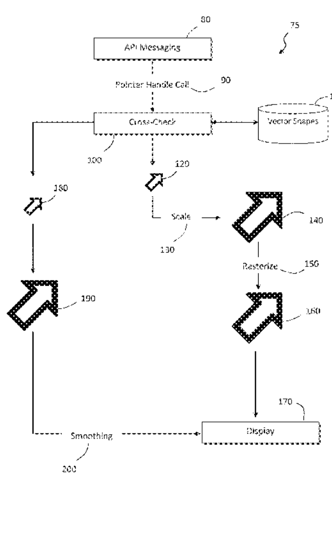

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Fig. 1

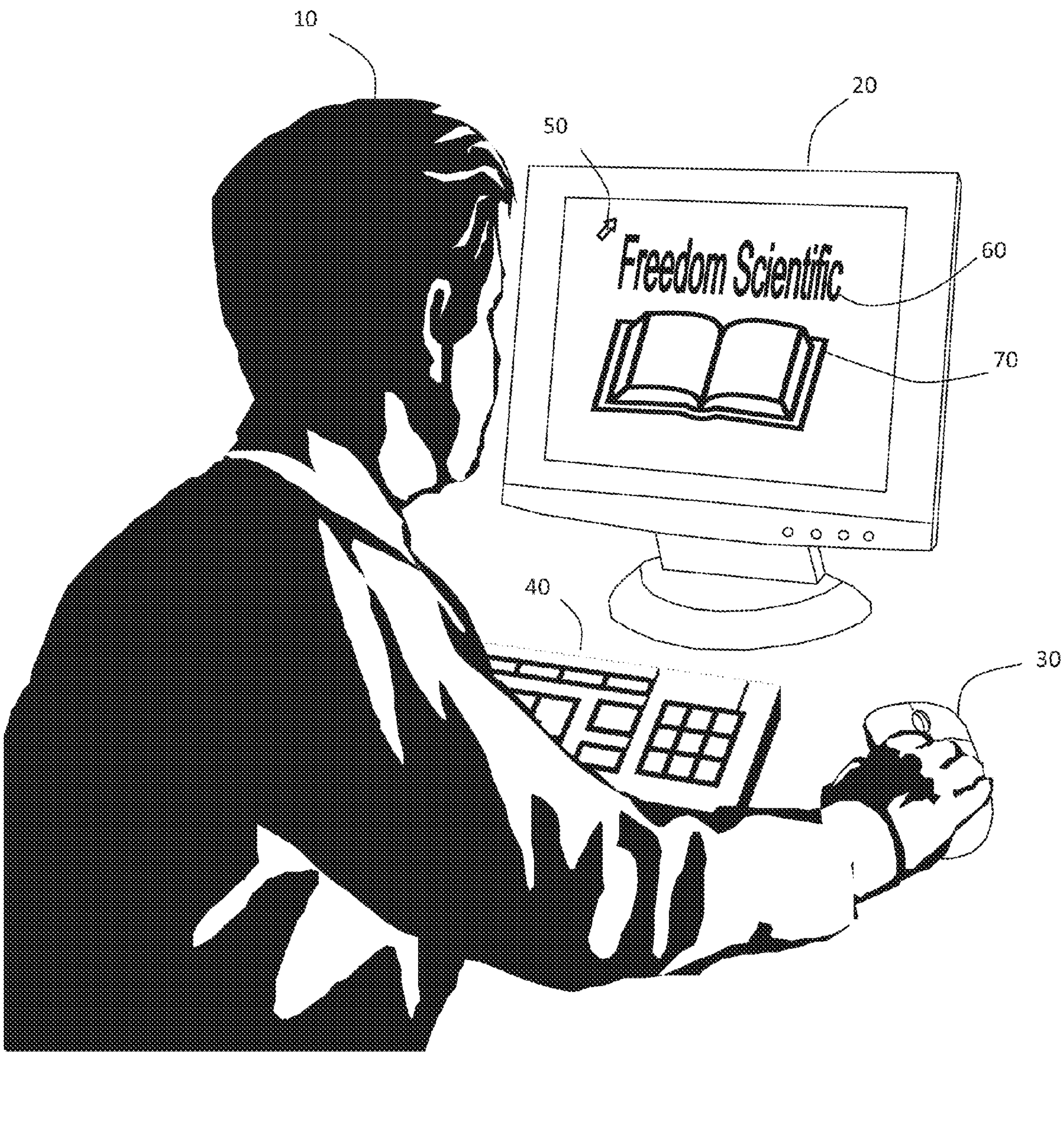


Fig. 2

Fig. 3

Fig. 4

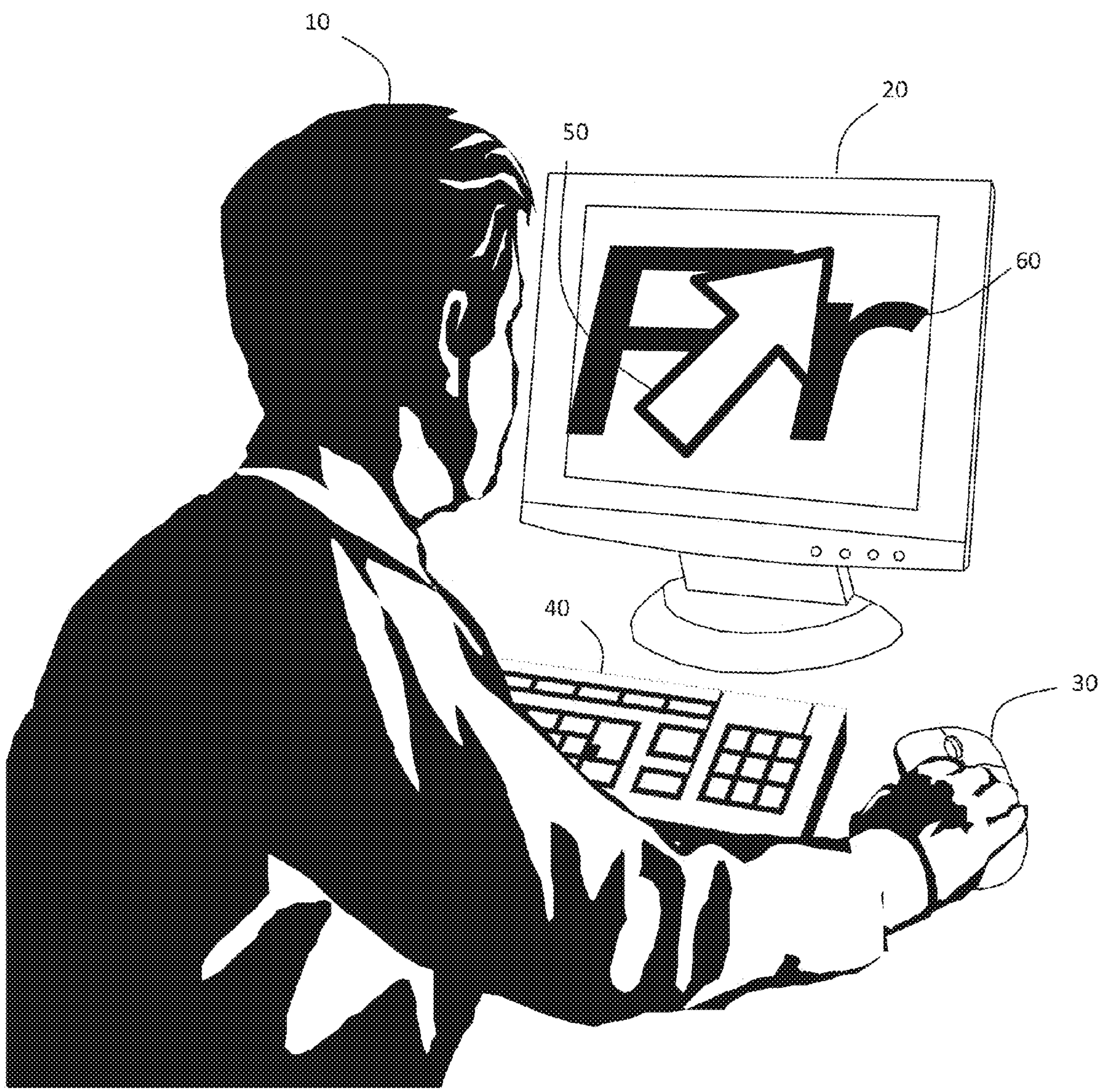


Fig. 5

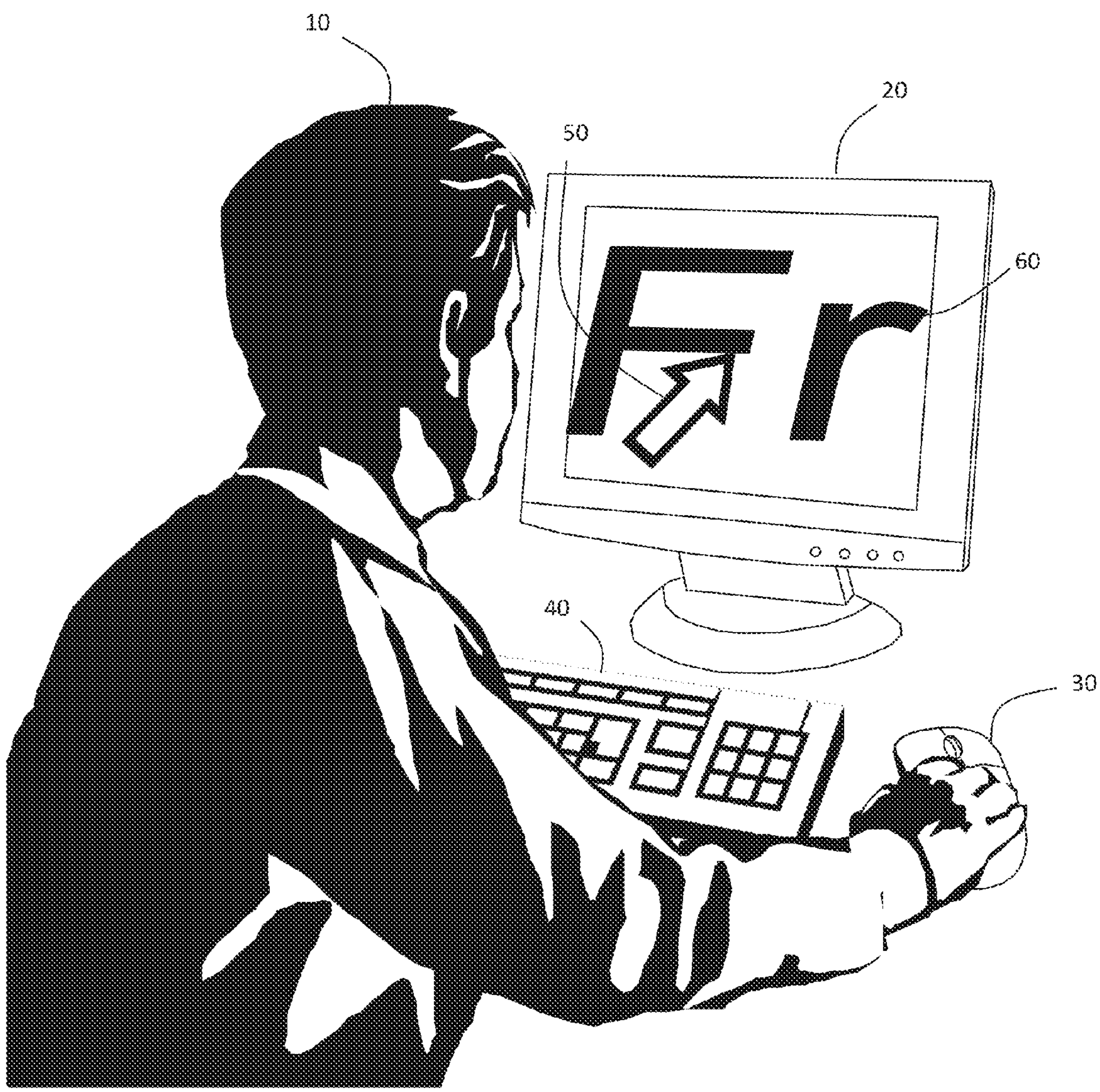
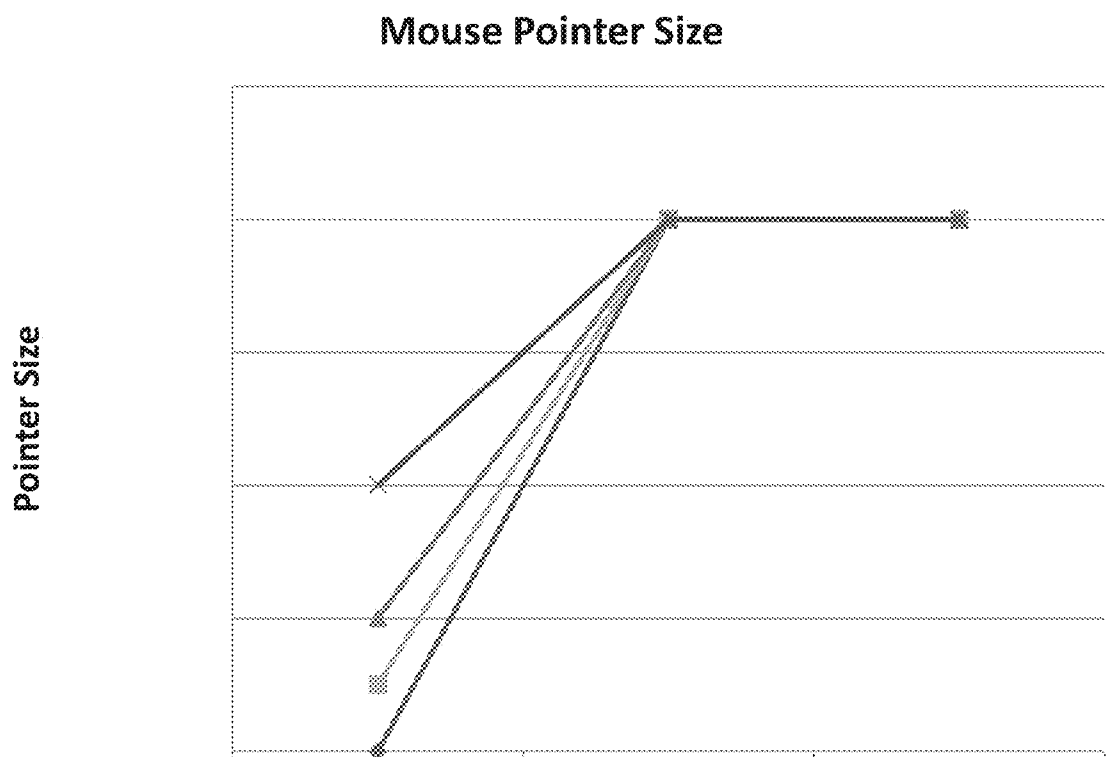
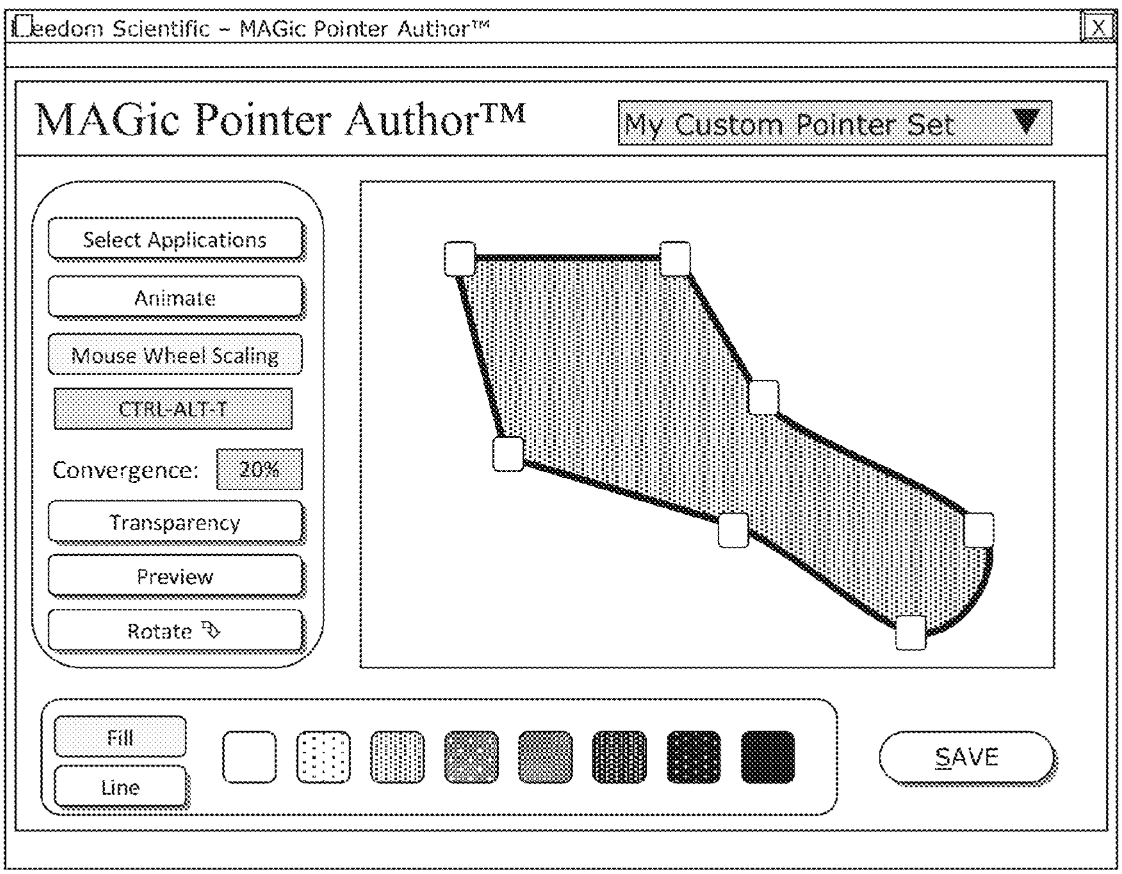


Fig. 6



	1X	16x	36x
Small (0.5x)	0%	20.00%	20.00%
Normal(1.0x)	3%	20.00%	20.00%
Large(2.0x)	5%	20.00%	20.00%
Huge(4.0x)	10%	20.00%	20.00%

Fig. 7



Freedom Scientific - MAGic Pointer Author™
X
MAGic Pointer Author™
My Custom Pointer Set
Select Applications
Animate
Mouse Wheel Scaling
CTRL-ALT-T
Convergence:
20%
Transparency
Preview
Rotate
Fill
Line
SAVE

Fig. 8

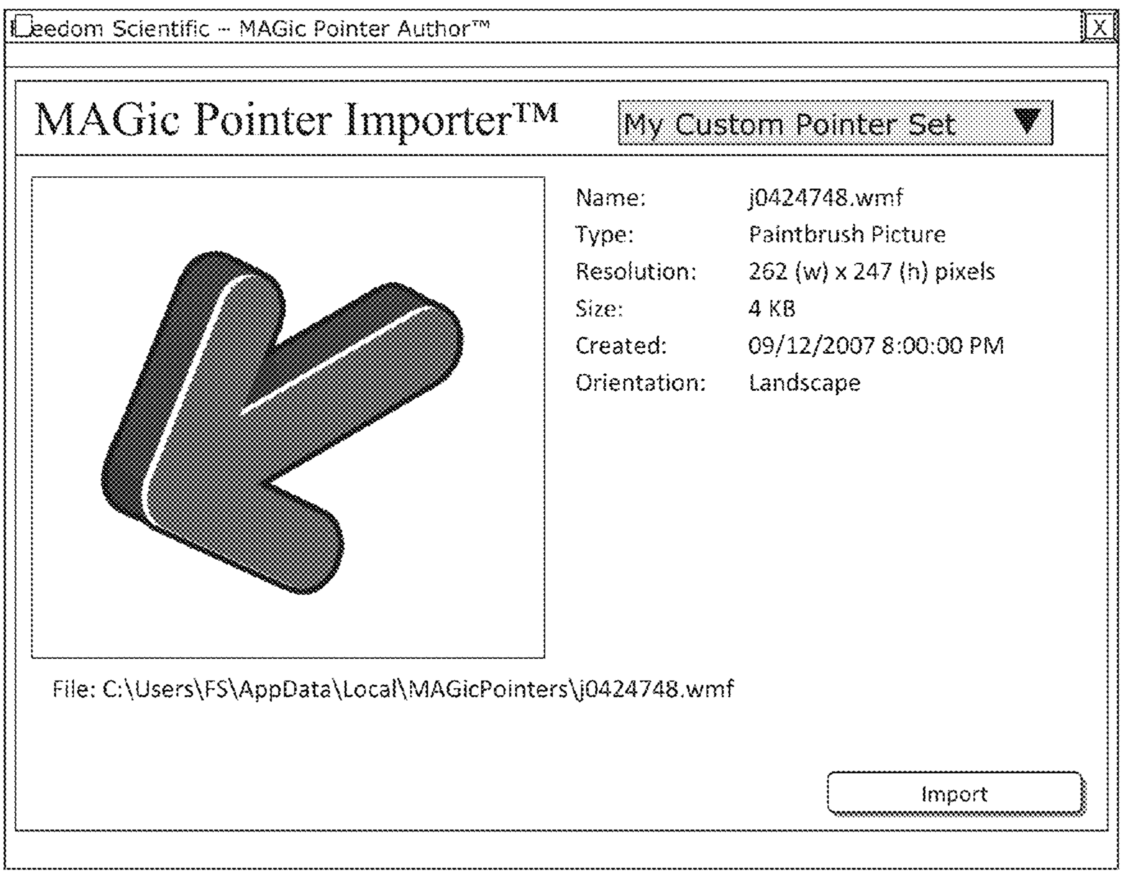

Freedom Scientific -- MAGic Pointer Author™
X
MAGic Pointer Importer™
My Custom Pointer Set
Name: j0424748.wmf
Type: Paintbrush Picture
Resolution: 262 (w) x 247 (h) pixels
Size: 4 KB
Created: 09/12/2007 8:00:00 PM
Orientation: Landscape
File: C:\Users\FS\AppData\Local\MAGicPointers\j0424748.wmf
Import

Fig. 9

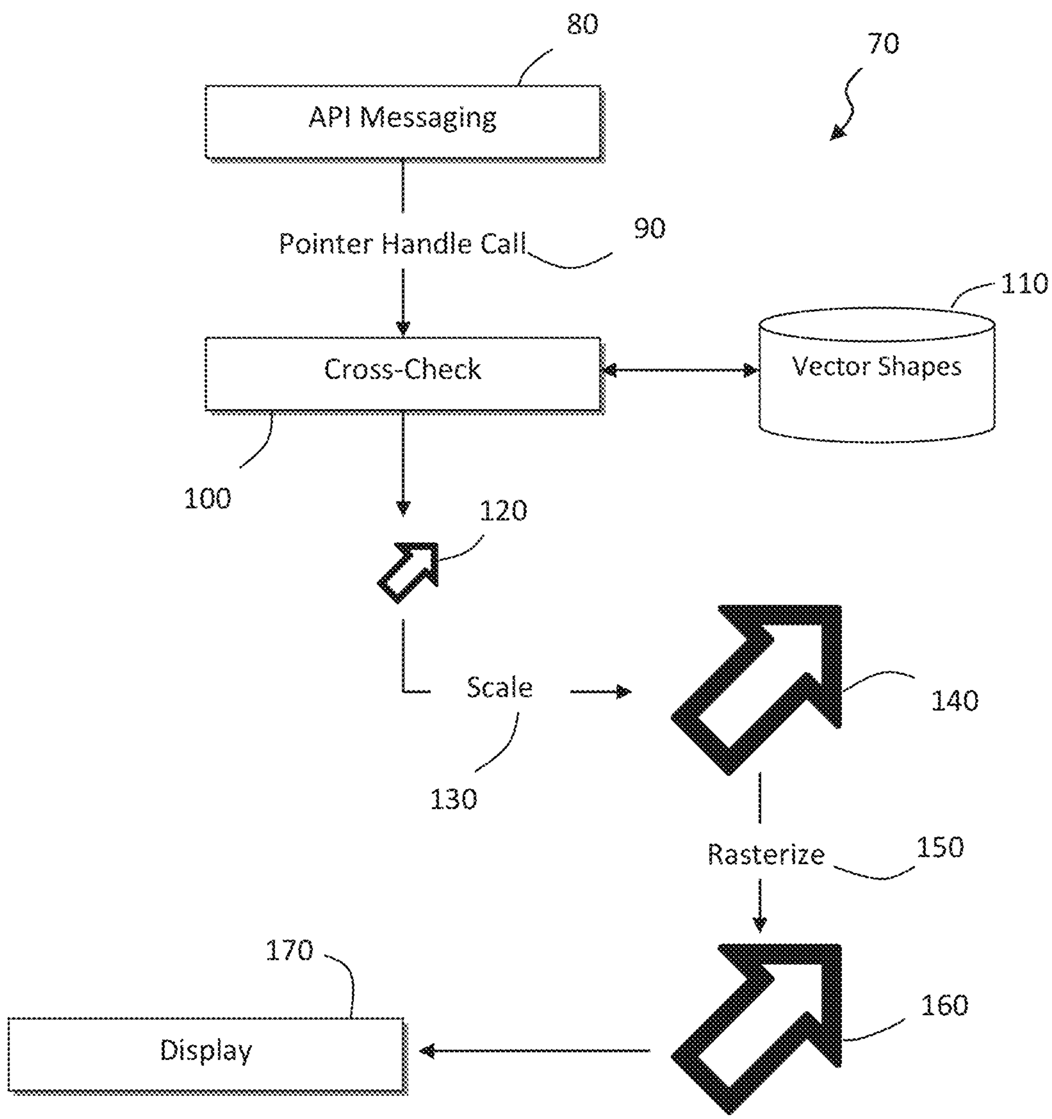

80
70
API Messaging
Pointer Handle Call
90
110
Cross-Check
Vector Shapes
100
120
Scale
140
130
Rasterize
150
170
160
Display

Fig. 10

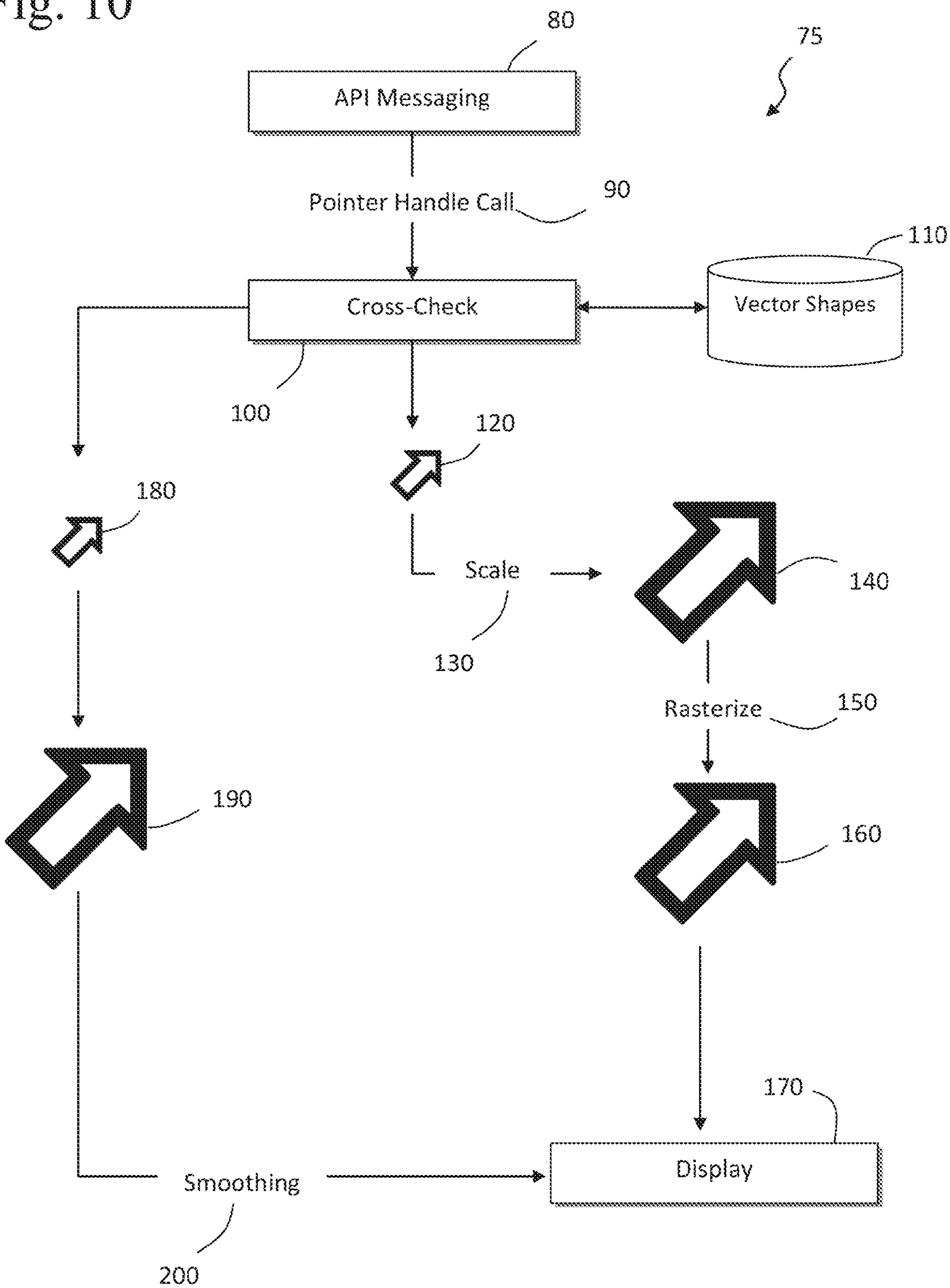

80
75
API Messaging
Pointer Handle Call
90
110
Cross-Check
Vector Shapes
100
120
180
Scale
140
130
Rasterize
150
190
160
170
Smoothing
Display
200

Fig. 11

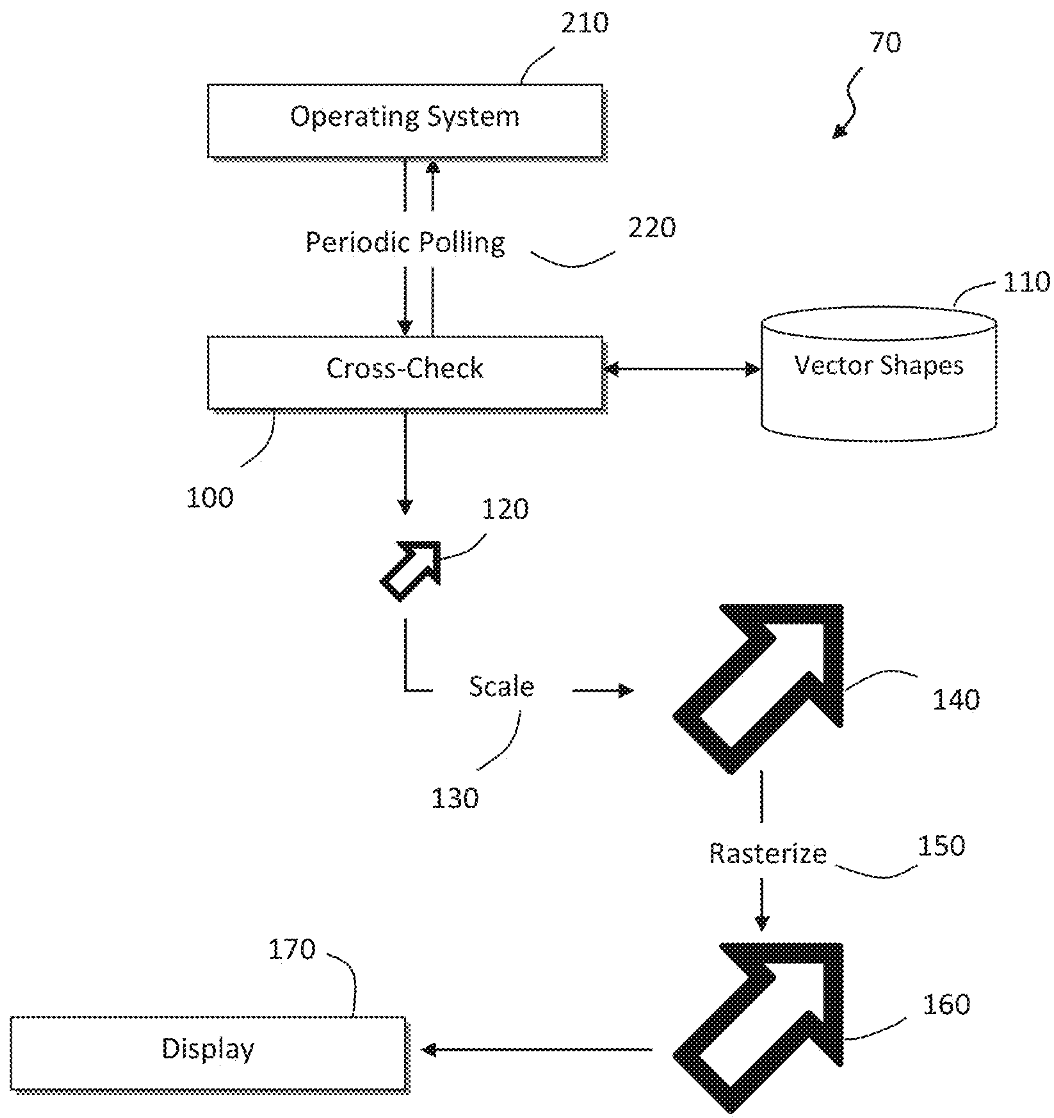
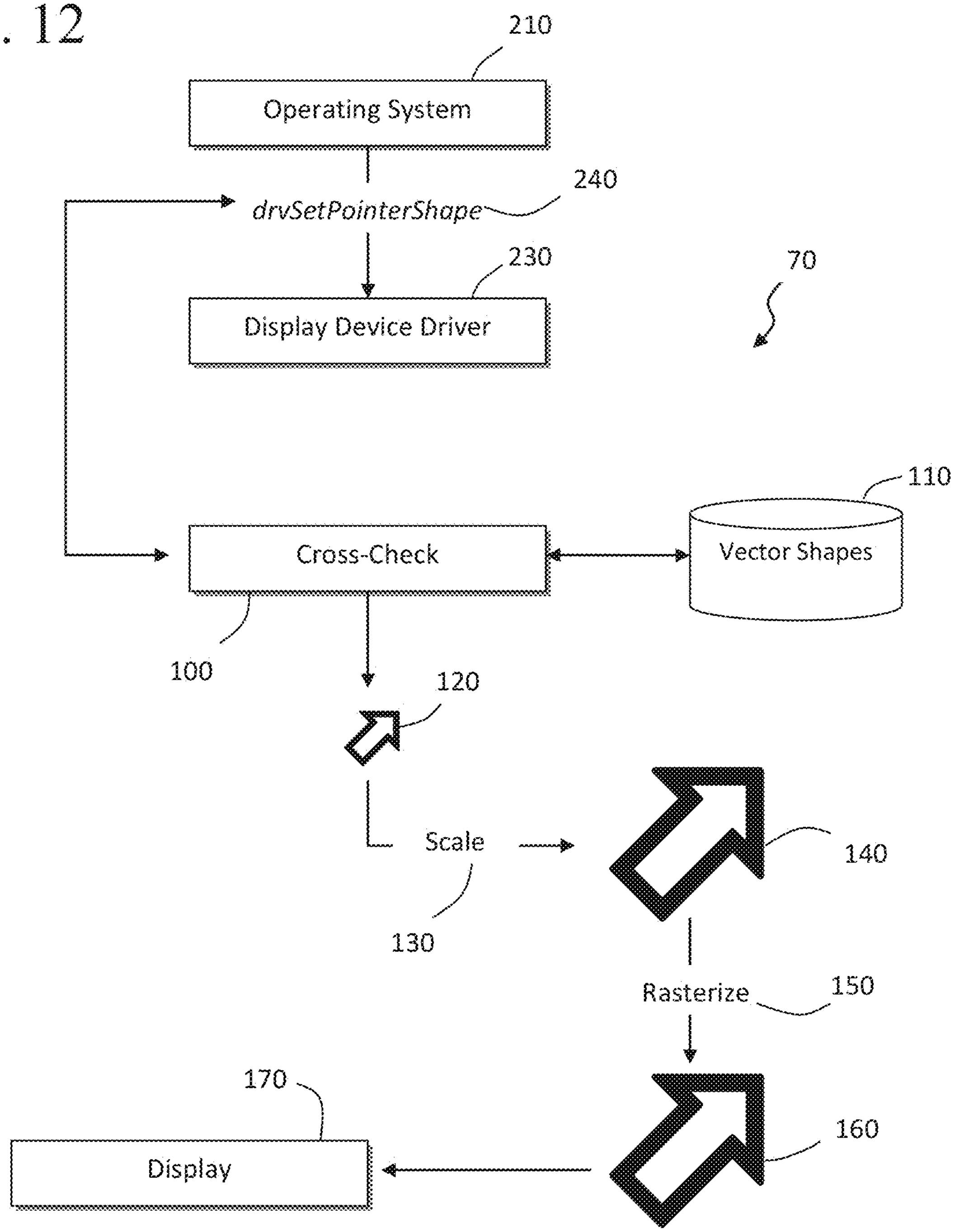
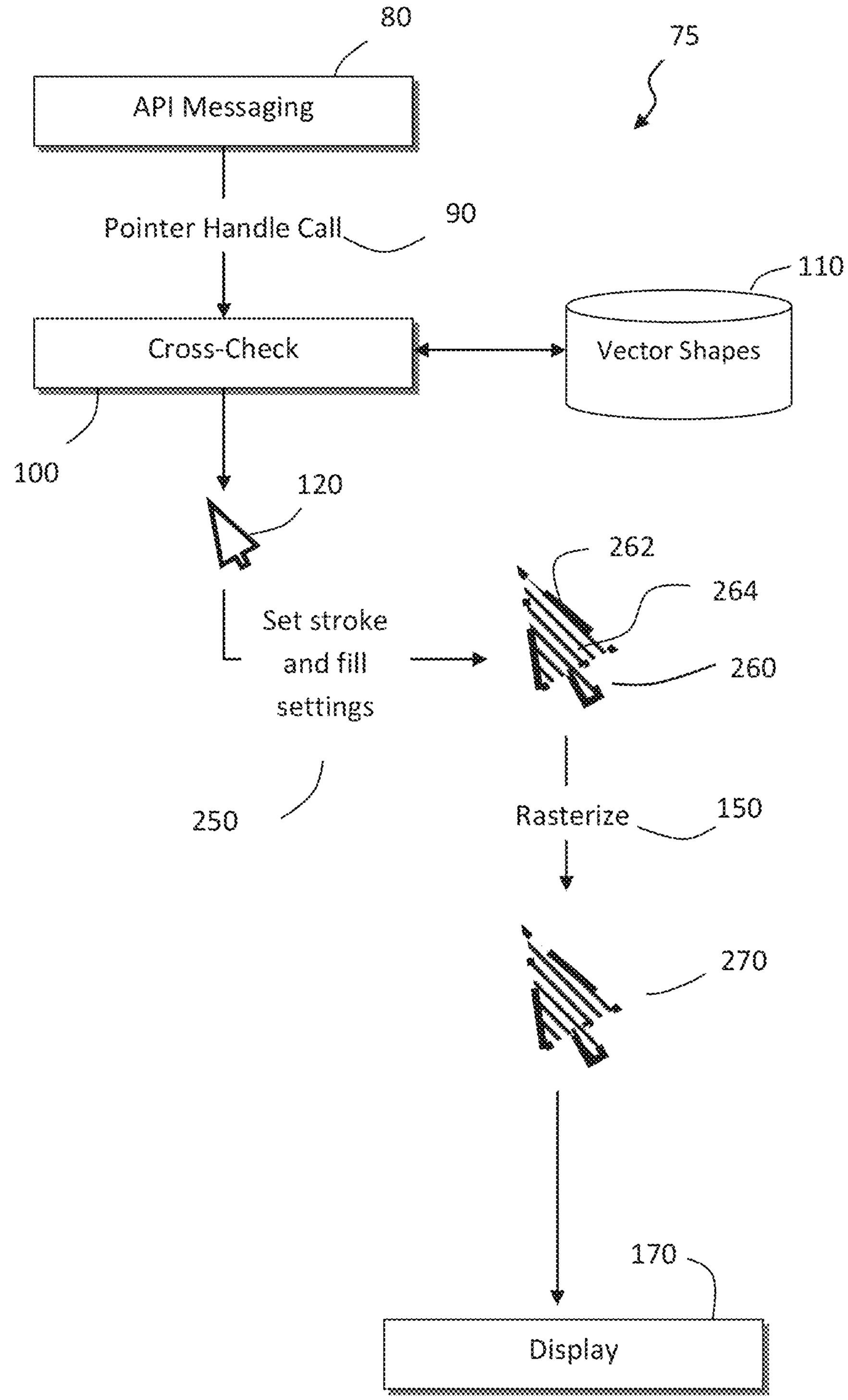

210
70
Operating System
Periodic Polling
220
110
Cross-Check
Vector Shapes
100
120
Scale
140
130
Rasterize
150
170
160
Display

Fig. 12



210
Operating System
240
drvSetPointerShape
230
Display Device Driver
70
110
Cross-Check
Vector Shapes
100
120
Scale
140
130
Rasterize
150
170
160
Display

Fig. 13


80
75
API Messaging
Pointer Handle Call
90
110
Cross-Check
Vector Shapes
100
120
262
264
Set stroke
and fill
settings
260
250
Rasterize
150
270
170
Display

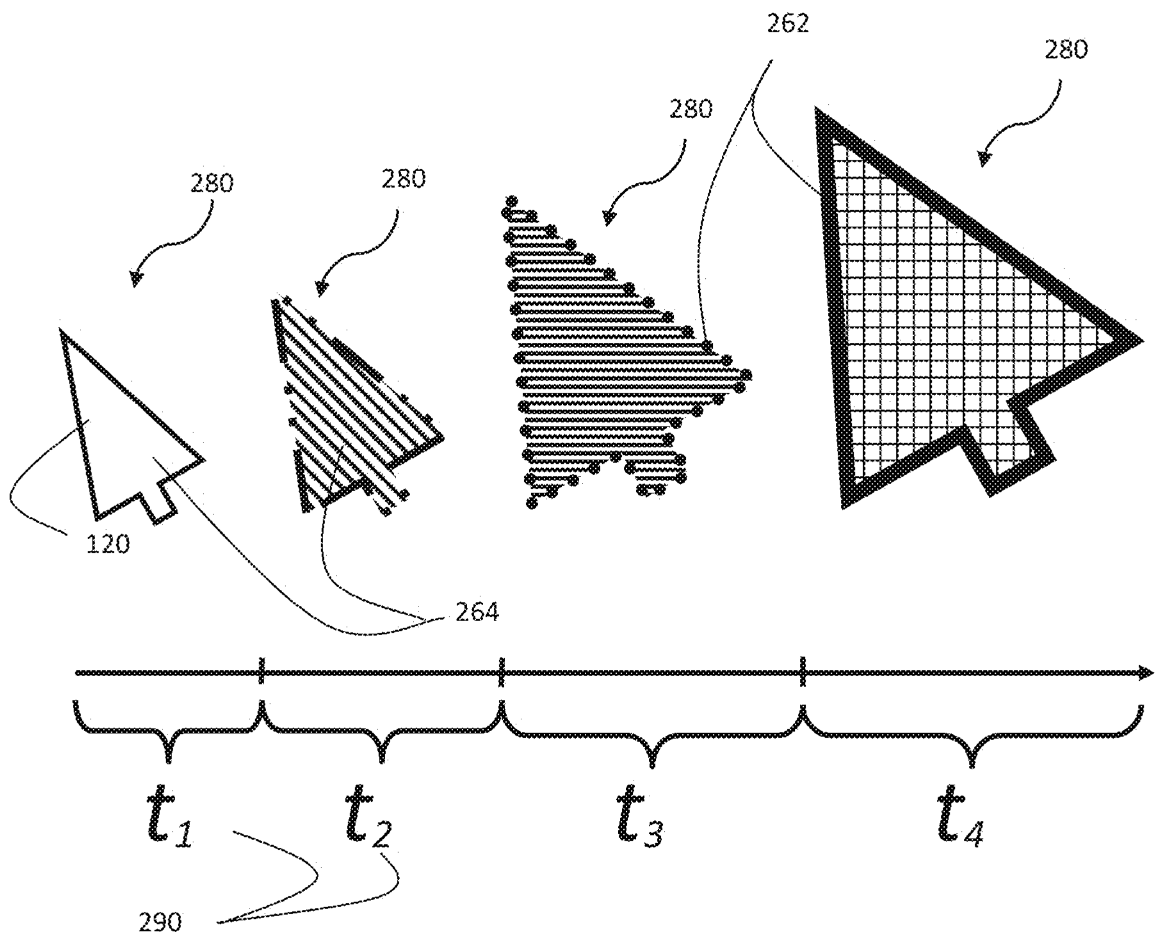


Fig. 14

Fig. 15

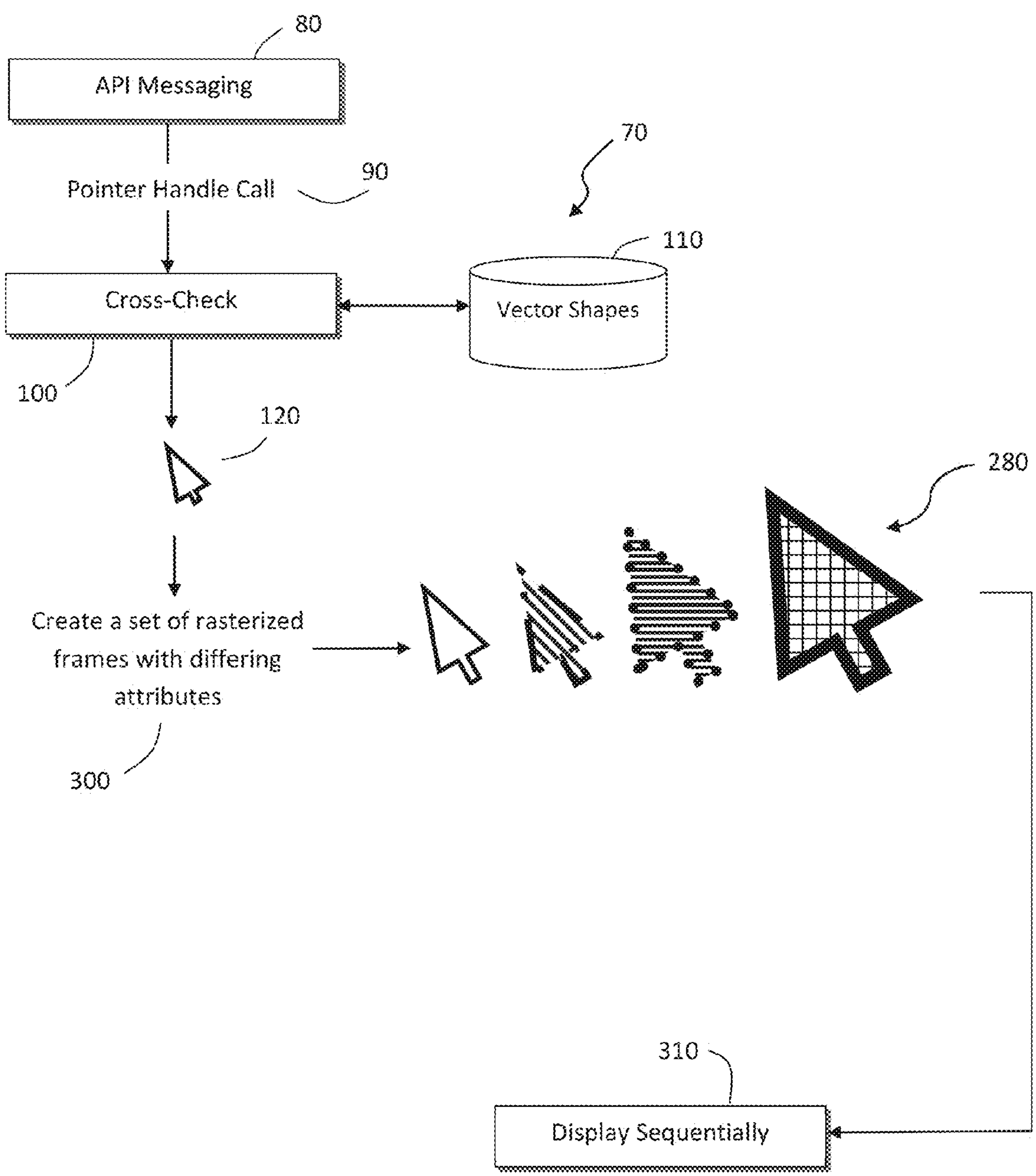
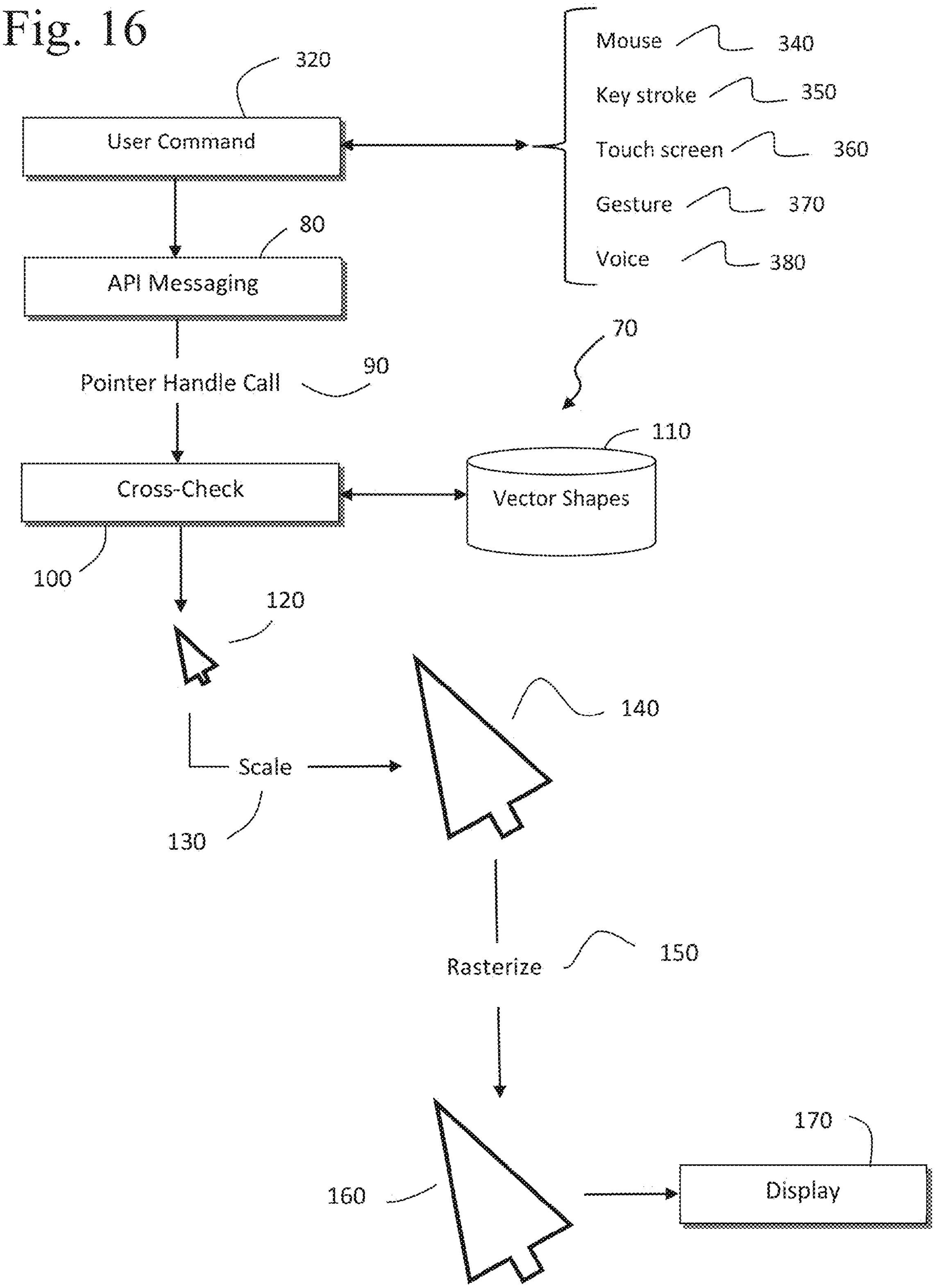

80
API Messaging
Pointer Handle Call
90
70
110
Cross-Check
Vector Shapes
100
120
280
Create a set of rasterized frames with differing attributes
300
310
Display Sequentially

Fig. 16



320
User Command
Mouse
340
Key stroke
350
Touch screen
360
Gesture
370
Voice
380
80
API Messaging
70
Pointer Handle Call
90
110
Cross-Check
Vector Shapes
100
120
140
Scale
130
Rasterize
150
170
160
Display

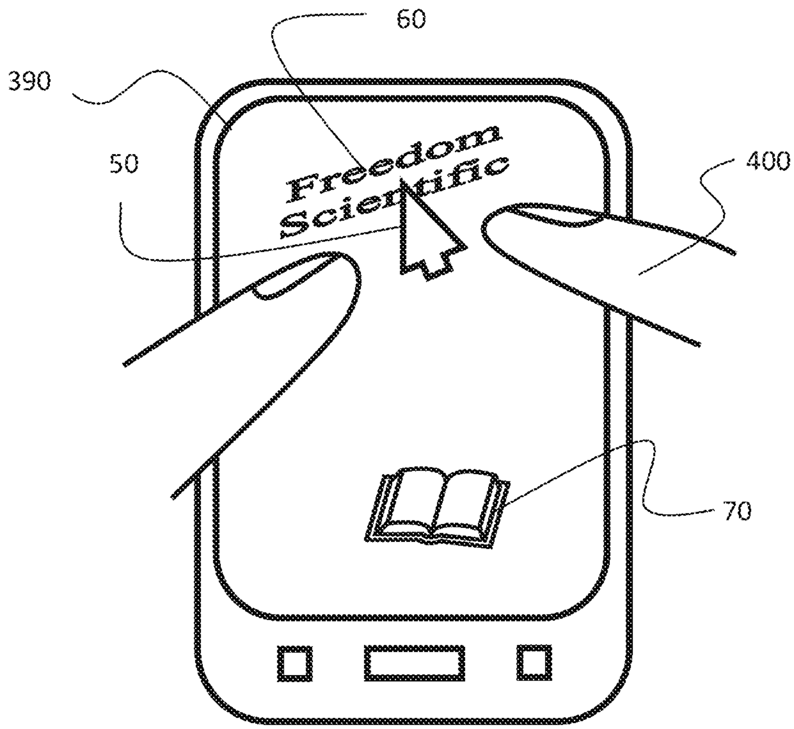


Fig. 17A

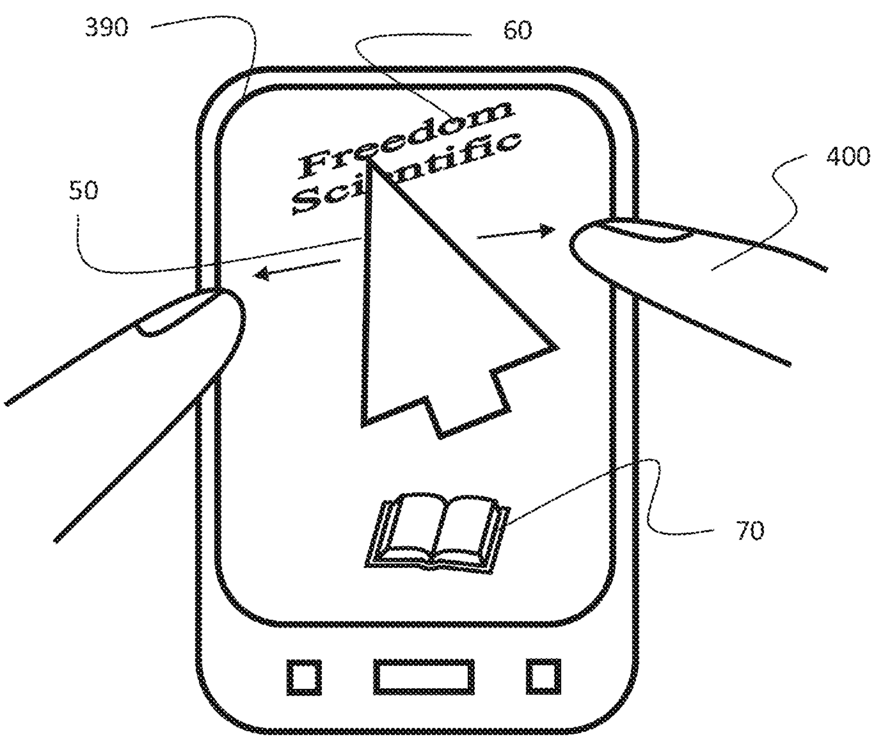


Fig. 17B

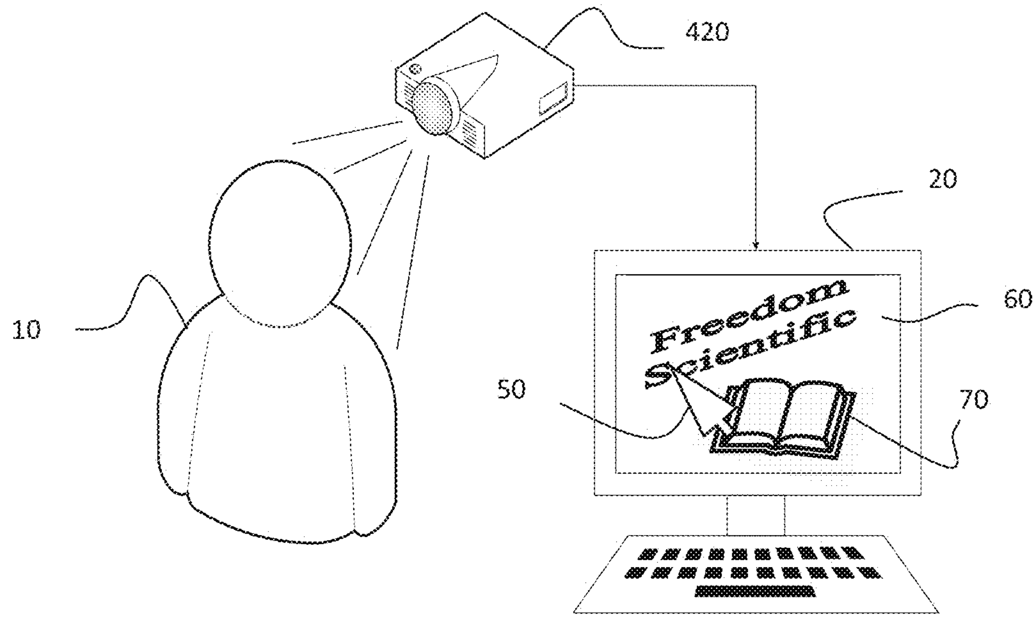


Fig. 18A

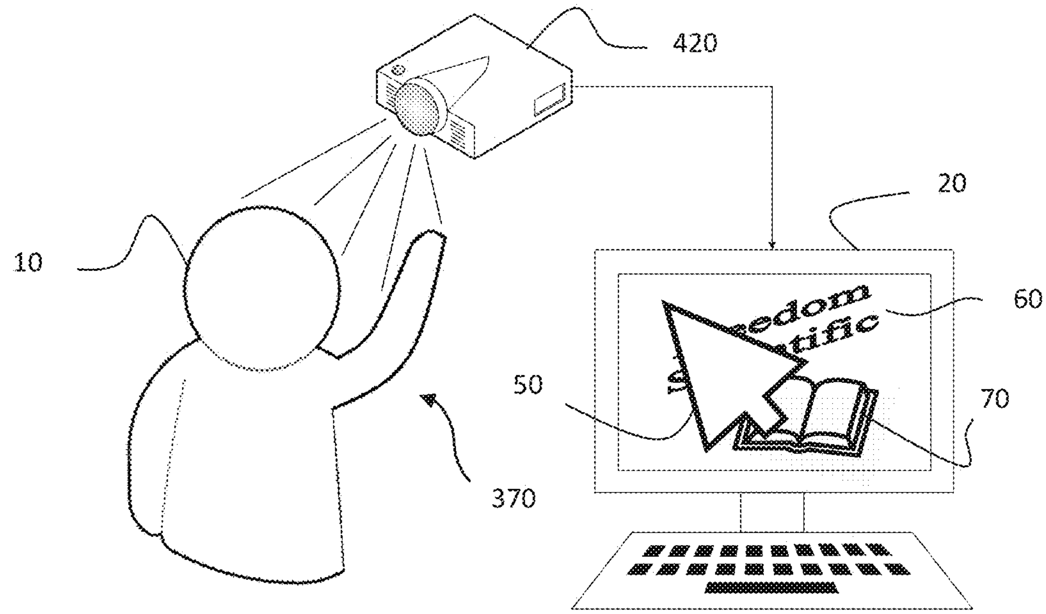


Fig. 18B

VECTOR-BASED CUSTOMIZABLE POINTING INDICIA

CROSS REFERENCE TO RELATED APPLICATION

This application is a continuation-in-part of U.S. patent application Ser. No. 12/828,765, entitled "VECTOR-BASED MAGNIFIED POINTER," filed Jul. 1, 2010 and claiming a priority date of Jul. 2, 2009, which is herein incorporated by reference.

FIELD OF INVENTION

This invention relates to customization of computer display interfaces, and more specifically, to customization of pointing indicia therein.

BACKGROUND OF THE INVENTION

Low vision individuals often require customization of computer screen interfaces to discern text and images. Customization systems may be built into the operating system itself or may comprise feature-rich, third-party products such as those sold under the MAGIC brand manufactured by Freedom Scientific, Inc., based in St. Petersburg, Fla.

A deficiency in the current state of the art is that of scaling pointing indicia such as a cursor or caret from small to large dimensions. For example, all mouse pointers have a discrete minimum and a common maximum size. The minimum size is a multiple of the system metrics for the mouse pointer. Generally, this metric is a 32×32 pixel square under operating systems sold by Microsoft Corporation out of Redmond, Wash. under the brands WINDOWS 7, VISTA, and XP. However, it is common for a mouse pointer to only occupy a 16×16 square, top-left justified, within this metric.

When the screen is magnified to a high level, such as 16-fold, the mouse pointer becomes pixelated and distracting to the user. Various smoothing techniques may be applied to reduce pixelation, but such processes consume CPU cycles and still lead to imperfect results. A serious problem with presenting a jugged and pixelated pointing indicia to a low vision user is that such flaws may undermine the confidence of a low vision user in her ability to see clearly: the user may be in doubt on whether the flaws are introduced through magnification of the pointing indicia are whether the poor vision of the user is the cause of the perceived imperfections.

Yet another deficiency is limited customization of pointing indicia. Some low vision users have difficulty distinguishing certain colors making it burdensome—or even impossible—to identify and observe the movement of the pointing indicium as it navigates a computer screen. Accordingly, what is needed is a vector-based pointing indicium whose outlining border and body may be independently colorized to enable the low vision users to better distinguish the pointing indicium from the background content of the screen.

Finally, although animation of pointing indicia is well known in the art, animation of a pixelated cursor—especially at higher magnification levels—suffers from the same flaws as described above. Therefore, there exists a need for a method of animating a vector-based pointing indicia.

SUMMARY OF INVENTION

The ability to smoothly scale, animate, or customize a mouse pointer or other graphical element is greatly enhanced by using vector-based images to create the initial, cached rasterized images that are ultimately used for final rendering (drawing to the screen). The reason for this is that the shapes and elements of the vector-based images are described by a formula, rather than by a bitmap. Currently, all mouse pointers are described by bitmaps. Bitmaps inherently become "blocky" and "stair-stepped" when magnified. Although there are post-scaling treatments that can be applied to artificially "smooth" a scaled bitmap, they are incapable of producing images that are as crisp and sharply edged as images produced from a scaled vector image.

An embodiment of the present invention provides a method of rendering a customized (i.e. colorized) pointing indicia. The method includes the steps of monitoring application program interface messaging, intercepting a call for a current system pointer identifier (such as its handle), accessing a stored collection of predefined vector shapes, and selecting a predefined vector shape correlated to the system pointer identifier from the collection of vector shapes. Predetermined stroke attributes are set for the selected vector shape, which is then rasterized and displayed as the pointing indicium. Some stroke attributes include color, opacity, width, line cap, line join, and dashing.

In an embodiment of the invention the desktop color under the hotspot for the pointing indicia is retrieved and the stroke is automatically modified to provide contrast of the boundary between the outer portion of the pointing indicia and the background. For example, a pure white background in RGB values would be 255,255,255. If the stroke color for a cursor was initially set by the user as white then the stroke would visually disappear when the pointing indicia was moved over a white background. For illustrative purposes, the background RGB and stroke RGB values are monitored in real time. If the sum of the positive integer differences between each RGB value was less than a threshold value, then the current software would automatically modify the stroke color to provide contrast. For example, if the threshold was set to an aggregate 150 then a background RGB value of 205,205,205 (light gray) would trigger an automatic change in the stroke color. By the same function, RGB values of 105,255,255 (teal) and 245,245,125 (yellow) would also trigger an automatic change because they do not sufficiently contrast from a white background. When the threshold is detected, the next step is to automatically change the stroke value. This can be done by any function that will distinctly change the RGB values. RGB values range from 0 to 255. Therefore, in our first example of 205,205,205 (light gray) we can assign a simple function to subtract 75 if the value is above 127 or add 75 if the value is below 127. Thus, 205,205,205 becomes 130,130,130 which is a dark gray and would contrast well on a white background. The 105,255,255 teal color stroke would automatically change to 180,130,130 which is brown (contrasting well over white).

An advantage of this feature is that the main body of the pointing indicia remains constant while the stroke value is variable so it doesn't blend into the background. Thus, the fill does not change colors responsive to the desktop background which could be visually distracting but the end user maintains a clear understanding of the boundaries of the pointing indicia by modification of only the stroke color. Another embodiment of the invention provides for customization of the pointing indicia by setting predetermined fill attributes for the vector shape prior to rasterizing, thus customizing the appearance of the body of the pointing indicia. Fill attributes include color and opacity.

In an embodiment, after the step of selecting a predefined vector shape corresponding to the current system pointer identifier, a set of rasterized frames is created based on the selected vector shape. Each rasterized frame has differing attributes, such as stroke and fill attributes and magnification level. The frames are displayed sequentially for a predetermined duration to render an animated pointing indicium.

In some embodiments of the invention, customization, animation, and magnification of the pointing indicia are performed responsive to user input. The user input may be of various types including the following: a key stroke, a mouse-wheel event, a mouse movement, various types of touch-screen input, user's hand gestures, body movement, facial expressions, voice commands, etc. To have a capability of detecting such user inputs the electronic device on whose screen the pointing indicium is being magnified may need to be equipped with a touchscreen, a keyboard, a mouse, a structured light scanner, and/or a microphone.

Instead of, or in addition to, passively intercepting a call for a current system pointer identifier, the operating system may be actively polled as to its current settings and the current system pointer identifier may be resolved.

To facilitate efficiency and responsiveness, previously rasterized shapes having customized stroke and fill attributes and magnification levels may be stored and recalled via a cache without having to customize, scale, and rasterize the shapes again. Storage of shapes is typically performed on available storage devices which may include, but are not limited to, magnetic hard drives, solid state drives, and/or RAM.

The invention may be embodied in one or more non-transitory computer-readable media having computer-executable instructions for performing a method of running a software program on a computer. The instructions stored on the non-transitory computer-readable media may be executed as an application, distinct from an operating system upon which it runs and interacts at a display driver level to modify screen output. Alternatively, the non-transitory computer-readable media may include an operating system, or update thereto, to achieve the novel functionality of the present invention.

BRIEF DESCRIPTION OF THE DRAWINGS

For a fuller understanding of the invention, reference should be made to the following detailed description, taken in connection with the accompanying drawings, in which:

FIG. **1** is a conceptual view of an embodiment of the invention showing a low-vision user viewing a screen at 1-fold magnification.

FIG. **2** is a conceptual view of an embodiment of the invention showing a low-vision user viewing a screen at 2-fold magnification.

FIG. **3** is a conceptual view of an embodiment of the invention showing a low-vision user viewing a screen at 4-fold magnification.

FIGS. **4-5** are a conceptual views of an embodiment of the invention showing a low-vision user viewing a screen at 16-fold magnification.

FIG. **6** is a graph showing a convergence point for maximum pointer indicia size at 16-fold magnification.

FIG. **7** is a graphic user interface for customizing a mouse pointer.

FIG. **8** is a graphic user interface for importing vector based files and assigning them as pointing indicia.

FIG. **9** is a diagrammatic view of an embodiment of the invention.

FIG. **10** is a diagrammatic view of an embodiment of the invention.

FIG. **11** is a diagrammatic view of an embodiment of the invention showing periodic polling of the operating system to obtain the current pointing indicia settings.

FIG. **12** is a diagrammatic view of an embodiment of the invention showing interception of dvrSetPointerShape between the operating system and the display device driver to obtain the current pointing indicia settings.

FIG. **13** is a diagrammatic view of an embodiment of the invention showing customization of the pointing indicia.

FIG. **14** is a depiction of a sequence of four frames of a pointing indicium vector shape, each frame having differing stroke, fill, magnification attributes, and a predetermined duration time.

FIG. **15** is a diagrammatic view of an embodiment of the invention showing animation of the pointing indicia.

FIG. **16** is a diagrammatic view of an embodiment of the invention showing magnification of a pointing indicium responsive to user input.

FIGS. **17**A-B are a conceptual view of an embodiment of the invention where the user input is received via a touch-screen.

FIGS. **18**A-B are a conceptual view of an embodiment of the invention where the user input is received via a structured light scanner.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Turning now to FIG. **1**, low vision user **10** manipulates views on monitor **20** via mouse **30** and keyboard **40**. Pointing indicium **50** is shown as an arrow cursor for exemplary purposes but could also be a caret. A cursor is the graphical image that represents the mouse and its movements on a Cartesian coordinate plane. It can take many shapes including, but not limited to, an arrow for pointing, a hand, an hourglass, or an I-shaped text selector. The caret, on the other hand, is the blinking indicia that is used to enter text. When low vision user **10** types on keyboard **40**, the letter appears as a caret, and the caret moves forward by 1 space. To view the relative magnification levels, display text **60** and display graphic **70** are provided in FIG. **1**.

FIG. **1** shows the GUI, pointing indicia **50**, display text **60** and display graphic **70** unmagnified. In FIG. **2**, pointing indicia **50**, display text **60** and display graphic **70** are shown conceptually at a 2-fold magnification level. In FIG. **3**, pointing indicia **50**, display text **60** and display graphic **70** are shown conceptually at a 4-fold magnification level. In FIG. **4**, pointing indicia **50**, display text **60** and display graphic **70** are shown conceptually at a 16-fold magnification level. At this level, pointing indicia **50** overlaps approximately twenty percent of the GUI area. According to an embodiment of the present invention, additional magnification of GUI and display text **60** de-couples the previously synchronized magnification of GUI and pointing indicia **50**. The size of pointing indicia **50** remains constant as the magnification of display text **60** continues past 16-fold magnification.

In FIG. **5**, the magnification of the pointing indicia **50** is de-coupled from the magnification of the GUI. GUI is magnified to 16-fold while pointing indicia **50** is magnified to only 4-fold. Low vision user **10** may de-couple magnification between pointing indicia **50** and GUI using keyboard **40**, mouse **30**, or a combination thereof. Other peripherals and input systems such as voice recognition systems may be used to effectuate the event. The de-coupling may also be automatically and intelligently achieved by the invention. For example, a predetermined threshold of mouse inactivity may be detected to incrementally increase or decrease (as desired) pointing indicia **50** magnification.

Mouse inactivity with extrinsic data may be used to make intelligent magnification decisions. For example, if a large amount of text is detected on the GUI in conjunction with mouse inactivity, a presumption may be made that the user is reading the text. In such case, a highly magnified cursor would only obscure text viewing. Alternatively, mouse **30** movement immediately after a period of mouse inactivity may invoke a rapid, stepped magnification of the pointing indicia **50** so that it can be easily located by low vision user as he resumes use of pointing indicia **50**. The stepped magnification may be used to provide an animated effect. In other cases, a plurality of incrementally modified vector shapes may provide other animation effects such a movement, rotation, waveforms and the like. As the shapes are vector-based, sized up to the magnification level, rasterized and cached, the quality of the graphic and the efficiency of cycling the cached images provide a substantial advantage over the current state of the art.

Yet another embodiment of the invention includes the step of algorithmically detecting erratic movements of mouse **30** by low vision user **10** following a period of mouse **30** inactivity which is indicative of difficulty in find the location of pointing indicia **50**. Erratic movement may include, but are not limited to, rapid side-to-side movement and circular movement. Responsive to detection of erratic movements, pointing indicia **50** is magnified according to the invention for a predetermined time period then returned to its preselected magnification level. An advantage of this embodiment over the prior art is that erratic movement must follow a predetermined period of inactivity as mouse movement perceived as "erratic" may be intentional should the user be engaged in a software application that calls for such movement.

FIG. **6** illustrates a convergence graph showing four (4) different pointer sizes denoted as small (♦), normal (■), large (▲) and huge (X). Small pointer size value is 0.5×. Normal pointer size value is 1.0×. Large pointer size value is 2.0×. Huge pointer size value is 4.0×. At a 1-fold magnification of the GUI, small, normal, large and huge pointer sizes cover an area of the GUI of ~0%, 3%, 5% and 10% respectively. As magnification of the GUI is increased, the variation in point sizes would produce drastically different user experiences. However, under an embodiment of the present invention, these pointer sizes are normalized at a 16-fold GUI magnification. As the GUI is magnified from 1-fold to 16-fold, small pointer size is increased substantially more relative to huge pointer size. Other magnification levels may also be selected for convergence.

Turning to FIG. **7**, a pointer authoring application is anticipated by the present invention to enable users to create vector shapes and assign them to pointer sets or individual pointers. Pointer sets contain collections of different graphic images for pointer cursor that change depending on the circumstances in which they are displayed. When selecting text to edit, a cursor may change to a vertical bar (I-beam). When panning around a document, the cursor may appear as a hand. Graphic-editing cursors may appear as pencils, brushes and paint buckets depending on the function. When waiting for an operation to finish, a "wait" image may appear such as an hourglass or clock. Other pointing options include selecting fill and line appearances for color, patterns, transparency and the like. Shapes may be assigned specific software applications. This may be accomplished by inspecting the operating system messaging to identify which application gains focus and applying the appropriate pointer set and/or cursor modification as desired. Because the present method allows the rapid, clean rendering of sharp and clear images at any dimension, animating the pointer cursor is possible. A sequence of stylizations and/or changes in dimension in the vector shape may be cached whereby the cursor may appear animated as

the sequence is displayed. Mouse wheel scaling parameters and hot-key combinations may be assigned to specific shapes and/or sets. For example, a user may hold down a keyboard combination while scrolling the mouse wheel in different directions to scale up or down the pointer cursor.

FIG. **8** shows an import application for assigning any vector-based graphic file to a specific pointer and/or pointer set. Vector file formats may include, but are not limited to, computer graphics metafile (CGM), scalable vector graphics (SVG), OpenDocument graphics (ODG), encapsulated postscript (EPS), portable document format (PDF), small web format (SWF), Windows metafile (WMF), Windows enhanced metafile (EMF), and XML paper specification (XPS). Another advantage of the present invention is that low-vision users are more likely to have a large collection of preexisting vector art to utilize as pointing indicia at any magnification level. In contradistinction, rasterized images are difficult to increase in size while maintaining clarity and sharpness due to pixelation of the bit-mapped image.

In FIG. **9**, an embodiment of the invention is shown as process **70**. API messaging **80** is monitored for pointer handle call **90**. Cross-check **100** is made against vector shape database **110** to match pointer handle call **90** with a preexisting shape in vector shape database **110**. Vector shape database **110** contains one or more vector shapes stored in memory. Database **110** may be a file directory, a structured file such as XML, a fully relational database or the like. Vector shape database **110** associates pointer handle call **90** with a correlated vector image. For example, if pointer handle call **90** requests a hand cursor image, cross-check **100** determines whether a vector image exists for the hand cursor image. If not, then a bit-mapped image is scaled up and smoothed. However, if a vector image does exist, then it is scaled up to the appropriate magnification level and then rasterized into a bitmap. Vector shape **120** is retrieved and scaling function **130** is applied to produce magnified vector shape **140**. Scaling is performed on a vector image by increasing or decreasing the length and width of the image. Because the scaling is done on a vector image, there is no pixelation as would be seen in bit-mapped scaling. Rasterizing process **150** is applied to magnified vector shape **140** to produce rasterized shape **160** which is then displayed **170** as the pointing indicia.

FIG. **10** illustrates an alternative embodiment of the invention (denoted as process **75**) that accommodates pointer handle calls **90** that do not have a corresponding shape in vector shape database **110**. In the event a match is not made, default bitmapped pointing indicia **180** is magnified to enlarged bitmapped pointing indicia **190**. Smoothing processing **200** is applied to enlarged bitmapped pointing indicia **190** and then displayed **170**. In another embodiment of the invention, upon finding no match for a vector shape, the system prompts low vision user **10** to associate an existing vector shape, create a new vector shape or import a vector-based file as a replacement for default bitmapped pointing indicia **180**. In yet another embodiment of the invention, a default vector shape is provided for pointer handle calls **90** that lack a corresponding shape in vector shape database **110**.

FIG. **11** illustrates periodic polling **220** of operating system **210** to obtain the current pointing indicia settings. Upon retrieving these settings, the predefined vector shape is selected that is correlated with the polled indicia settings.

In FIG. **12**, an alternative method of obtaining the pointer shape includes the step of intercepting drvSetPointerShape value **240** between operating system **210** and display device driver **230**. The drvSetPointerShape value **240** is cross-checked **100** to see if there is a correlated vector shape **110** that is indexed to drvSetPointerShape value **240**. Using drvSetPointerShape value **240** is most appropriate for the fifteen (15) predefined (non-obsolete) cursor types available in the MICROSOFT WINDOWS application programming interface specification.

FIG. **13** illustrates an embodiment of the invention, according to which, stroke **262** and fill **264** are customizable. In step **250**, attributes of stroke **262** and fill **264** of vector shape **120** are set to produce a customized vector shape **260**. Rasterizing process **150** is applied to customized vector shape **260** to create a rasterized customized vector shape **270**, which is then displayed in step **170** as the pointing indicium. The most significant attribute of stroke **262** and fill **264** is color because certain color combinations are easier to perceive and observe for extended periods of time, which may be especially beneficial for visually impaired users. Other attributes of stroke **262** include the following: opacity, width, line cap, line join, and dashing; the opacity of fill **264** may also be adjusted.

FIG. **14** illustrates an embodiment of the invention according to which the pointing indicia may be animated. The animation involves creating a sequence of rasterized frames **280** of vector shape **120**. Attributes of each subsequent rasterized frame **280** differ from those of preceding rasterized frame **280**—these attributes include stroke **262**, fill **264**, and/or magnification level. A predetermined time duration **290** is associated with each rasterized frame **280**. To produce the animation effect, rasterized frames **280** are displayed sequentially, wherein each rasterized frame **280** is displayed for corresponding time duration **290**. In some embodiments, time durations **290** may be identical for all rasterized frames **280**, whereas in alternative embodiments, certain rasterized frames **280** may be displayed for a longer duration than others. The sequence of rasterized vector images may be stored in a graphics filed format compatible with the operating system of choice. For example, the ANI file format is used for animated mouse cursors on the MICROSOFT WINDOWS operating system. The ANI file format is based on the MICROSOFT RIFF file format (resource interchange file format) which is used as a container for storing the individual frames. A preferred file format will contain the default frame rate, sequence information (order of rasterized vector images), cursor hotspot and the individual frames (rasterized images into the ICO bitmap format). In addition, individual frame rates for each image within the sequence may be set.

The method of animating a vector-based pointing indicium is diagrammatically illustrated in FIG. **15**. After pointing indicium vector shape **120** is selected, a set of rasterized frames **280** with differing attributes of vector shape **120** are created in step **300**. Rasterized frames **280** are then displayed sequentially in step **310** rendering an animated pointing indicium.

Various embodiments of the invention described above may be performed responsive to a specific user input. FIG. **16** diagrammatically illustrates an embodiment in which vector-based pointing indicia are magnified responsive to a user input **320**. User input **320** may be received as a mouse event **340**, a key stroke **350**, a touchscreen event **360**, a gesture **370**, a voice command **380**, or a combination thereof.

FIGS. **17**A-B illustrate an example of touchscreen event **360**. The user may use this type of input with any device having a touchscreen **390**. In the example shown in FIGS. **17**A-B, user's fingers **400** simultaneously contact touchscreen **390** and slide apart while maintaining contact with the surface of the touchscreen **390**. As shown in FIG. **17**B, responsive to touchscreen event **360**, pointing indicium **50** may be magnified independently of display text **60** and display graphic **70** according to the process diagrammatically depicted in FIG. **16**. In alternative embodiments, magnification of display text **60** and/or display graphic **70** may be coupled with magnification of pointing indicia **50**. Alternatively, touchscreen event **360** may be in a form of a touch-hold, a touch-tap, a touch-drag, a touch-flick, a pinch, a multi-touch, a touch gesture pattern, a stencil input, etc.

According to an embodiment of the invention depicted in FIGS. **18**A-B, gestures **370** are received via a structured light scanner **420**. Structured light scanners **420**, such as MICROSOFT KINECT, are known in the art and are used to identify a variety of gestures **370**. FIGS. **18**A-B illustrate magnification of vector-based pointing indicium **50** responsive to gesture command **370**. When user **10** raises an arm, structured light scanner **470** identifies gesture **370**. Responsive to gesture **370**, vector based-pointing indicium **50** is magnified according to the process diagrammatically depicted in FIG. **16**. In the embodiment shown in FIGS. **18**A-B, pointing indicium **50** is magnified independently of display text **60** and display graphic **70**. In alternative embodiments, magnification of pointing indicia **50** may be coupled with magnification of display text **60** and/or display graphic **70**.

Hardware and Software Infrastructure Examples

The present invention may be embodied on various computing platforms that perform actions responsive to software-based instructions. The following provides an antecedent basis for the information technology that may be utilized to enable the invention.

The computer readable medium described in the claims below may be a computer readable signal medium or a computer readable storage medium. A computer readable storage medium may be, for example, but not limited to, an electronic, magnetic, optical, electromagnetic, infrared, or semiconductor system, apparatus, or device, or any suitable combination of the foregoing. More specific examples (a non-exhaustive list) of the computer readable storage medium would include the following: an electrical connection having one or more wires, a portable computer diskette, a hard disk, a random access memory (RAM), a read-only memory (ROM), an erasable programmable read-only memory (EPROM or Flash memory), an optical fiber, a portable compact disc read-only memory (CD-ROM), an optical storage device, a magnetic storage device, or any suitable combination of the foregoing. In the context of this document, a computer readable storage medium may be any tangible medium that can contain, or store a program for use by or in connection with an instruction execution system, apparatus, or device.

A computer readable signal medium may include a propagated data signal with computer readable program code embodied therein, for example, in baseband or as part of a carrier wave. Such a propagated signal may take any of a variety of forms, including, but not limited to, electro-magnetic, optical, or any suitable combination thereof. A computer readable signal medium may be any computer readable medium that is not a computer readable storage medium and that can communicate, propagate, or transport a program for use by or in connection with an instruction execution system, apparatus, or device.

Program code embodied on a computer readable medium may be transmitted using any appropriate medium, including but not limited to wireless, wire-line, optical fiber cable, radio frequency, etc., or any suitable combination of the foregoing. Computer program code for carrying out operations for aspects of the present invention may be written in any combination of one or more programming languages, including an object oriented programming language such as Java, C#, C++ or the like and conventional procedural programming languages, such as the "C" programming language or similar programming languages.

Aspects of the present invention are described below with reference to flowchart illustrations and/or block diagrams of methods, apparatus (systems) and computer program products according to embodiments of the invention. It will be understood that each block of the flowchart illustrations and/or block diagrams, and combinations of blocks in the flowchart illustrations and/or block diagrams, can be implemented by computer program instructions. These computer program instructions may be provided to a processor of a general purpose computer, special purpose computer, or other programmable data processing apparatus to produce a machine, such that the instructions, which execute via the processor of the computer or other programmable data processing apparatus, create means for implementing the functions/acts specified in the flowchart and/or block diagram block or blocks.

These computer program instructions may also be stored in a computer readable medium that can direct a computer, other programmable data processing apparatus, or other devices to function in a particular manner, such that the instructions stored in the computer readable medium produce an article of manufacture including instructions which implement the function/act specified in the flowchart and/or block diagram block or blocks.

The computer program instructions may also be loaded onto a computer, other programmable data processing apparatus, or other devices to cause a series of operational steps to be performed on the computer, other programmable apparatus or other devices to produce a computer implemented process such that the instructions which execute on the computer or other programmable apparatus provide processes for implementing the functions/acts specified in the flowchart and/or block diagram block or blocks.

The advantages set forth above, and those made apparent from the foregoing description, are efficiently attained. Since certain changes may be made in the above construction without departing from the scope of the invention, it is intended that all matters contained in the foregoing description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

CLAIM TERM GLOSSARY

Caching—storing data in electronic storage devices which may include, but are not limited to, magnetic hard drives, solid state drives, and/or RAM.

Desktop Background—the graphic user interface canvas underneath the pointing indicia. This may include commonly referenced "wall paper" such as static images but also is used in the context to include anything underneath the pointing indicia include software application windows, dialog boxes, media display windows and the like.

Fill—a body of a shape within the outline

Multi-touch—type of touchscreen event involving the user making contact with the surface of the screen at two or more points.

Pinch—type of touchscreen event involving the user making a two-point contact with the surface of the screen, and changing the distance between the points of contact while maintaining the contact

Pointing indicia—a caret or cursor visual element that moves about the graphic user interface typically in response to a peripheral device, such as a mouse, track pad, touchscreen or the like

Rasterized frame—a pixel image resulting from rasterization of a vector shape.

Rasterizing—a process of converting a vector shape into a pixel image that can be displayed on a video screen

RGB—an additive color model in which red, green, and blue light are added together in various ways to reproduce a broad array of colors. In the context of the present invention a digital, 8-bit per channel triplet array is used as an exemplary embodiment.

Stroke—a line outlining a shape

Structured light scanner—a device for measuring the three-dimensional shape of an object using projected light patterns and a camera system, the device being capable to detect body movements and gestures.

System pointer identifier—an identifier, such as a handle, that lets the system determine which pointing indicium is being displayed at a current point in time

Touch-drag—type of touchscreen event involving the user making a contact with the surface of the screen and maintaining the contact while sliding the contacting member along the screen surface

Touch-flick—type of touchscreen event involving the user making a contact with the surface of the screen and then quickly sliding the contacting member along the screen surface and discontinuing the contact

Touch-gesture pattern—type of touchscreen event involving the user making a contact with the surface of the screen and then sliding the contacting member in a predetermined pattern while maintaining the contact

Touch-hold—type of touchscreen event involving the user making and maintaining a continuous contact with the surface of the screen for a predetermined period of time.

Touch-tap—type of touchscreen event involving the user making brief contact with the surface of the screen and immediately discontinuing the contact

Touchscreen—a display device that allows a user to interact with a computing device by making contact with the surface of the screen.

User Input—is end user feedback, whether intentional (as in a command) or unintentional received by a computing device running the computer software application controlling the appearance of the pointing indicium.

Vector shape—a geometrical shape in computer graphics based on mathematical expressions

What is claimed is:

1. A method of displaying customized pointing indicia comprising the steps of:

identifying a current system pointer identifier from an operating system's application program interface;

accessing a stored collection of predefined pointing indicia vector shapes;

selecting a predefined vector shape from the collection, the selected vector shape correlated to the current system pointer identifier;

setting predetermined stroke attributes for the selected vector shape defining an outline thereof;

rasterizing the selected vector shape; and

displaying the rasterized vector shape.

2. The method of claim **1**, further comprising the stroke attributes being selected from the group consisting of color, opacity, width, line cap, line join, and dashing.

3. The method of claim **1**, further comprising setting predetermined fill attributes for the selected vector shape defining a body thereof prior to displaying the rasterized vector shape.

4. The method of claim **3**, further comprising the step of detecting the RGB value of the background desktop under the pointing indicia and automatically recoloring the stroke color to provide distinct contrast between background desktop and stroke color.

5. The method of claim **4**, wherein the stroke color differs from the fill color establishing a visibly distinct outline border around the pointing indicia.

6. The method of claim **1** further comprising the step of caching rasterized shapes for reuse.

7. The method of claim **1**, wherein the stroke attributes are set responsive to user input.

8. The method of claim **7**, further comprising the user input being selected from the group consisting of a key stroke, a mouse-wheel event, a mouse gesture, and a combination thereof.

9. The method of claim **7**, wherein the user input is received via a touchscreen, the user input being selected from the group consisting of a touch-hold, a touch-tap, a touch-drag, a touch-flick, a pinch, a multi-touch, a touch gesture pattern, a stencil input, and a combination thereof.

10. The method of claim **7**, wherein the user input is sensed by a structured light scanner, the user command being selected from the group consisting of a hand gesture, a body movement, a facial expression, and a combination thereof.

11. The method of claim **7**, wherein the user input is a voice command received through a microphone.

12. A method of animating pointing indicia comprising the steps of:

identifying a current system pointer identifier from an operating system's application program interface;

accessing a stored collection of predefined pointing indicia vector shapes;

selecting a predefined vector shape from the collection, the selected vector shape correlated to the current system pointer identifier;

creating a set of rasterized frames of the selected vector shape, the rasterized frames having differing attributes; and

sequentially displaying the rasterized frames for a predetermined duration, thereby creating an animated pointing indicia effect.

13. The method of claim **12**, further comprising the attributes of the rasterized frames of the selected vector shape being selected from the group consisting of a stroke color, a stroke weight, a stroke opacity, a fill color, a fill opacity, a magnification level, and aspect ratios.

14. The method of claim **12**, wherein at least one attribute of a subsequent rasterized frame differs from a preceding rasterized frame by a degree sufficient to produce a visual animated effect when the rasterized frames are displayed sequentially.

15. The method of claim **12**, further comprising the step of caching rasterized shapes for reuse.

16. The method of claim **12**, wherein the steps of creating a set of rasterized frames and rendering an animated pointing indicium by sequentially displaying the rasterized frames are performed responsive to user input.

17. The method of claim **16**, further comprising the user input being selected from the group consisting of a key stroke, a mouse-wheel event, a mouse gesture, and a combination thereof.

18. The method of claim **16**, wherein the user input is received via a touchscreen, the user input being selected from the group consisting of a touch-hold, a touch-tap, a touch-drag, a touch-flick, a pinch, a multi-touch, a touch gesture pattern, a stencil input, and a combination thereof.

19. The method of claim **16**, wherein the user input is sensed by a structured light scanner, the user input being selected from the group consisting of a hand gesture, a body movement, a facial expression, and a combination thereof.

20. The method of claim **16**, wherein the user input is a voice command received through a microphone.

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